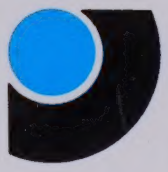
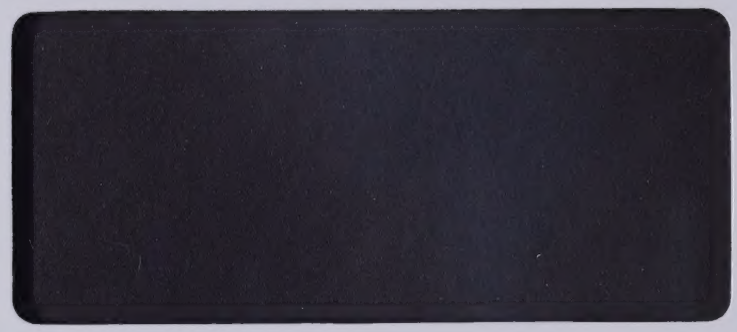


WILCOM

A PLANTRONICS COMPANY

MODEL T304
CURRENT METER

wilcom products, inc., laconia, n.h.
BOX 508 • D.W. HIGHWAY 03247 U.S.A.
TEL. 603/524-2622 TWX 510-298-1120



MODEL T304
CURRENT METER

WARRANTY

Wilcom Products warrants that the products herein described will be free from defects in materials and workmanship under normal use for a period of twenty-four months from the date of shipment. If within that period a product is proved to be defective in materials or workmanship, Wilcom products will, at its option, either repair or replace the product subject to the terms and conditions below. This warranty does not apply to non-repairable parts such as fuses, to parts subject to normal wear and tear, to any part of the product that has been repaired or altered by others than Wilcom or its authorized agent, to parts subjected to negligence, vandalism, abuse, improper maintenance or storage, or parts used or subjected to any condition that does not constitute normal use.

The foregoing warranty does not include reimbursement for transportation, packing or like expenses connected with repair and/or replacement.

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MODEL T304
CURRENT METER

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MODEL T304
CURRENT METER
(and Probes)

1.0 GENERAL

1.1 Description

1.1.01 The Model T304 Current Meter is a portable, battery powered set designed to amplify and display the output of Current Probe Model T305 for two inch cable. It also can be used to amplify the current output of four inch Current Probe Model T272. Used with either of these probes the T304 provides measurement of ac current from 10 mA (at one-tenth of the most sensitive range) to 100 A (full scale on least sensitive range). This makes it ideal for measurement of power system induced currents in cable shields and ground connectors. A selector switch on the T304 sets the internal gain for use with either the T305 or the T272 Probe.

1.1.02 A third current probe, the Model T172 also can be used with the Model T304 Current Meter. Details for using the T305, T272 and the T172 Current Probe with the Model T304 are outlined in section 4.0, Operating Instructions.

1.1.03 The T304 is powered by two standard nine-volt transistor radio batteries. While 300 hours of intermittent operation is normally possible between battery changes, prolonged measurement of very high currents, particularly with the T272, will shorten the battery life.

1.1.04 Figure 1 on page 3-2 is a front panel photograph of the Model T304 Current Meter and the Model T305 Current Probe.

2.0 SPECIFICATIONS

2.1 T304 Current Meter

2.1.01 Range: 7 switch-selectable ranges from 100 mA to 100 A full scale.

2.1.01 Frequency: (With T305 or T272): 60 Hz to 3 kHz.

2.1.03 Accuracy: 50 Hz to 30 kHz: With T305: ±(10% of reading +3% of full scale);
With T272: ±(5% of reading +2% of full scale).

2.1.04 Operating Power

Batteries:	Two 9-volt transistor radio batteries, type 216 or similar.
Battery Life:	300 hours intermittent duty (depending on battery ratings).

2.1.05 Environmental

Operating Temperature:	0 °C to 50 °C
Humidity:	95% at 35 °C
	40% at 50 °C
Altitude (non-operating):	15,000 meters

2.1.06 Dimensions

Width:	4-3/8 inches
Height:	6-3/8 inches
Depth (including cover):	4-1/4 inches

2.1.07 Weight

Approximately 3 pounds

2.2 T305 Current Probe

2.2.01 Clamp-on Current Transducer for 2" maximum diameter conductor.

2.2.02 Turns: 2400

2.2.03 Shunt: Internal resistance shunt for 24.5 mV/ampere output into high impedance load.

2.2.04 Accuracy when used with NMS: ±(15% of reading plus measuring set accuracy).

3.0 PANEL CONTROLS AND CONNECTIONS

3.1 Current Measurements

3.1.01 Current Input — ac current is supplied to the test set through dual banana jacks, labeled CURRENT PROBE, located above the current meter.

3.1.02 Current Probe Selector Switch — To the left of the CURRENT PROBE input jacks is a selector switch labeled T305/T272. The switch designations are labeled according to the probe types recommended for use. However, a T172 Current Probe can be used with the switch in the T305 position.

3.1.03 Current Range Switch — Seven current ranges are available from 100 mA ac full scale through 100 A ac full scale.

3.2 Power

3.2.01 ON/OFF switch — Power is supplied to the T304 by two nine volt batteries through an ON/OFF toggle switch located in the upper right corner of the front panel.

3.2.02 BATT TEST — When the current meter is in use, the condition of the batteries may be checked by pushing the BATT TEST push button and observing if the dial indicator reaches the BATT OK range.

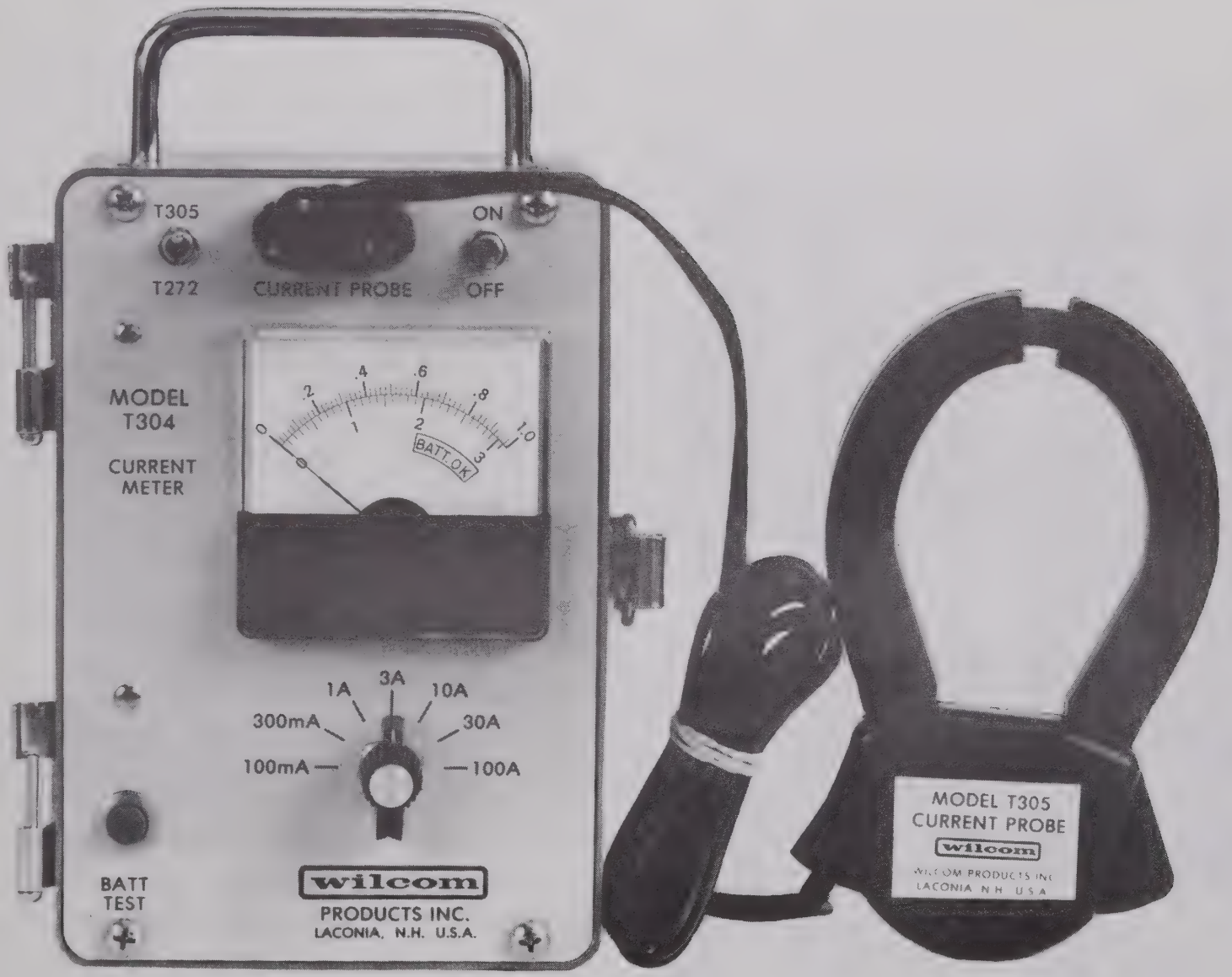

T305
T272
CURRENT PROBE
ON
OFF
MODEL
T304
CURRENT
METER
BATT OK
1A
3A
10A
300mA
30A
100mA
100A
BATT
TEST
wilcom
PRODUCTS INC.
LACONIA, N.H. U.S.A.
MODEL T305
CURRENT PROBE
wilcom
LACONIA N.H. U.S.A.

Figure 1

4.0 OPERATING INSTRUCTIONS

4.1 Power

4.1.01 The T304 is powered by two standard nine-volt transistor radio batteries (Eveready 216 or equivalent). Power is supplied to the set by an ON/OFF toggle switch.

4.1.02 The condition of the batteries may be determined by holding the BATT TEST push button in with the toggle switch ON and observing the current meter. If the dial indicator is in the BATT OK range, the batteries have sufficient power to operate the set.

4.1.03 If the dial indicator is not in the BATT OK range, the batteries are replaced as described in Section 6.4, Battery Replacement.

4.2 Current Probe Measurements

4.2.01 A Current Probe consists of a clamp-on transducer that inductively couples induced ac current to a measuring set by means of an Adapter Cable. The T272 Current Probe, for example, may be used with a variety of measuring sets. Therefore three adapter cables for the T272 are available for specific uses. Each use requires a different shunt resistance built into the adapter cable. Therefore, only those current probes and adapter cables described below are recommended for use with the T304 Current Meter if direct readings in amperes or milliamperes are desired.

1. The T305 Current Probe as supplied with the T304 Current Meter.

2. The T272 Current Probe with a plain adapter cable (no shunt resistor). The T272-02 adapter cable, for example, has a shunt resistor built into the connector. Refer to the T272 Brochure.

3. The T172 Current Probe and Adapter Cable can be used as supplied except a T172-01 adapter connector is required.

NOTE: Both the T172 and the T305 Current Probes have a shunt resistor built into the clamp-on transducer. The values of these shunts are such that the very low dynamic input impedance of the T304 Current Meter will result in the shunts having little effect except to cause some high frequency loss (3 dB point at 4 to 8 kHz) on the T304 most sensitive range. Refer to the T305 Specification Section.

APPLICATIONS

4.3 Cable Shield Continuity Measurements -

4.3.01 Most cases of noise and low frequency induction on aerial cable will be accompanied by an appreciable amount of power line ground return ac current in the cable shield and in the supporting strand. This current can effectively be used to determine the location of discontinuities and high resistance bonds that can reduce the effectiveness of the cable shield.

NOTE: These procedures have been developed for use in areas where MGN (multi-grounded neutral) power systems are used.

4.3.02 Many variables affect the amount of induced current in cable shields; therefore, the amount of current that will be flowing on a particular cable shield cannot always be accurately predicted. Instead, the following procedure relies on two basic test precedures.

1. Sequentially check all current flow paths along the cable shield route, little or no ac current on a shield connection or a section of cable shield usually indicates an open or high resistance ground return. An open shield is also possible.

   CAUTION: HAZARDOUS VOLTAGES MAY BE INDUCED ON BUNCHED CONDUCTORS IF THERE IS AN OPEN SHIELD. USE CAUTION WHEN PERFORMING ALL TESTS.

2. Bypass all cable shield bond connections and suspected discontinuities with a temporary jumper. An increase in shield current indicates a high resistance bond, an open bond or a discontinuous shield.

Verification of shield continuity can be made by analyzing the amount of induced current on individual shields compared to the induced current through bonding conductors connected to ground rods, taps, MGN's etc. (See FIGURE 1.)

4.4 Systematized Testing -

4.4.01 Experience has shown that it is best to follow a systematic procedure in correcting faults on a cable rather than to haphazardly select seemingly potential trouble spots and make random repairs to a cable. Major bonding problems have been found in splices and on ground connections in cable vaults located in central offices which have a bearing on both noise and protection problems. In addition, grounding of cables and cable supporting strands varies considerably from location to location. Consequently, there is no certainty as to how much effect each bond will have on noise. In some cases a cumulative effect may be observed as each defective bond is repaired, but in a good many cases little effect is observed until the last defective bond is corrected and then a very dramatic reduction in noise may be noted.

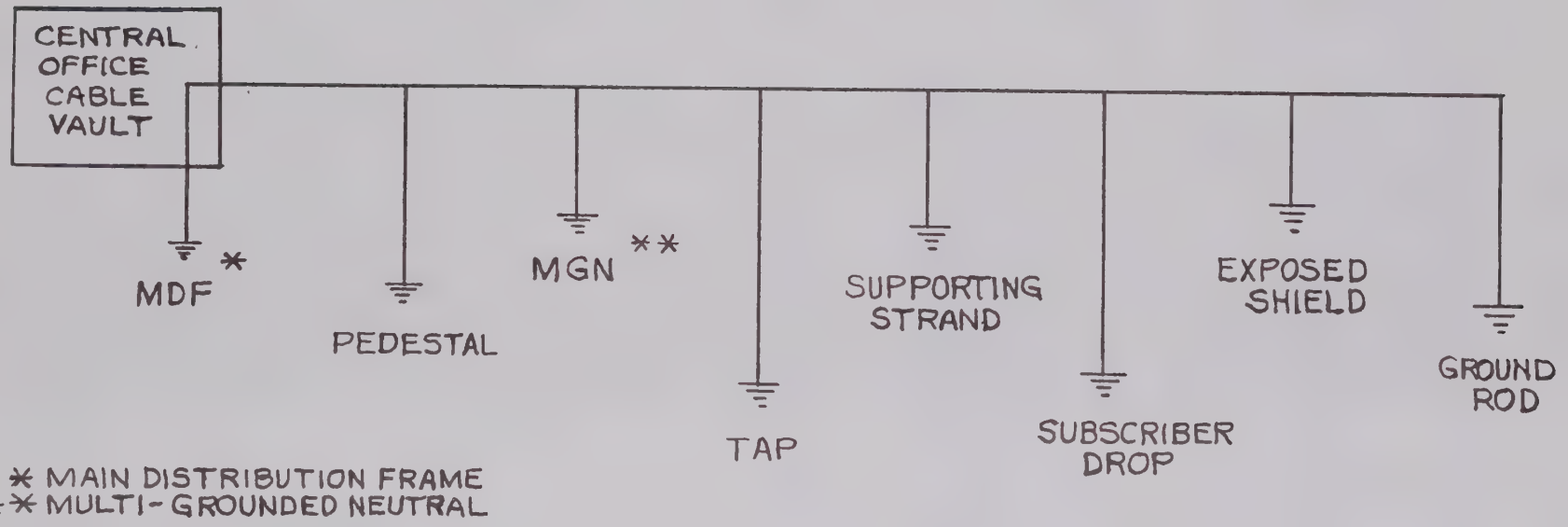


FIGURE 1
GROUND CONNECTIONS ON SHIELDED CABLE

4.4.02 As a result of field experiences it is strongly recommended that tests on a cable be started in the cable vault of the central office to be sure that all splices are properly bonded, all ground connections are in good condition, and all cable shields are tied together as required for protection purposes. After the vault bonding conditions have been checked and are in accordance with all requirements, then each cable splice should be tested in sequence and the necessary corrective action taken to repair all defective bonds. It may also be desirable to check bonds between ground conductors or terminals and cable supporting strands, and between the grounded strand and cable shield. Defective ground connections to cables are not uncommon due to corrosion of bonding clamps or to loose clamps. Cold flow of materials under mechanical pressure can also affect the quality of a bond. Figure 1 lists the various potential paths to ground.

4.4.03 If a number of lateral cables are connected to the main cable, they also should be tested as they can introduce noise in the main cable. Ground connections to the cable should be checked also.

WARNING: A FULL EVALUATION OF THE EFFECT OF HIGH VOLTAGE BREAKDOWN ON THE EQUIPMENT HAS NOT BEEN MADE AND IT IS NOT KNOWN WHAT HIGH VOLTAGE CAN BE TOLERATED. CONSEQUENTLY, CARE MUST BE EXERCISED NOT TO COME IN CONTACT WITH ANY HIGH VOLTAGES IN MAKING TESTS.

4.5 Trouble Shooting Procedures -

4.5.01 After taking and recording current measurements at the C.O. main frame (or vault) between the cable shields and ground bus, proceed along the cable route.

SHIELD CURRENT MEASUREMENT

EXCHANGE _____ LINE NO _____ DATE _____ SHEET___ OF___

PED. POLE OR TERMINAL #	OFFICE SIDE	FIELD SIDE	GROUND TYPE	CURRENT	COMMENTS

4.5.02 AERIAL CABLE TERMINAL TESTING

1. Individually measure and record the shield current at each aerial cable terminal on both sides of the terminal being tested. Record the data (in mA) on a form similar to the one shown in figure 2. The measurements are made as follows:

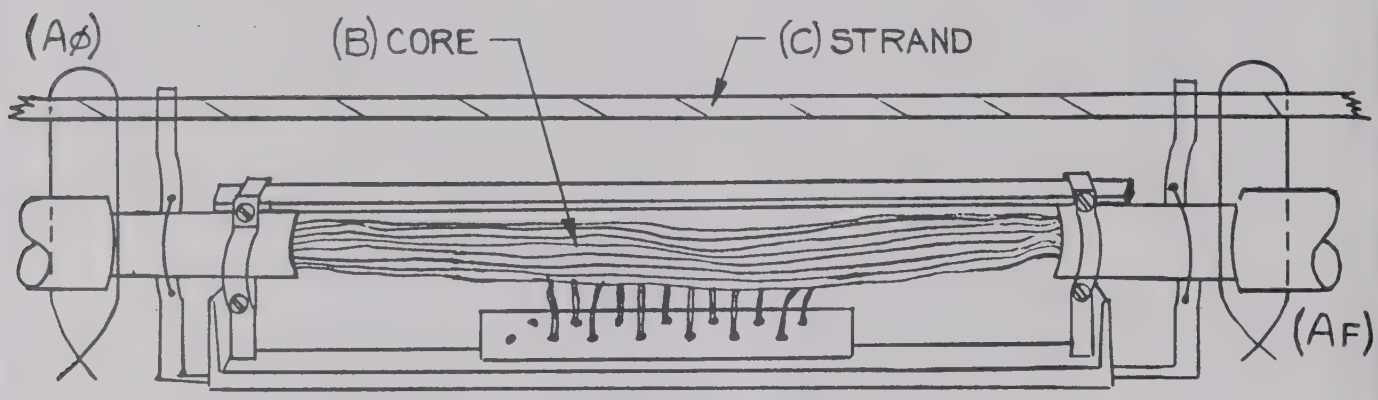


FIGURE 3

Shield Current = A* - (B+C)

a. Record the current flow with the T305 clamp around the supporting strand and the shield (A).
b. Record the current through the core (B).
c. Record the current through the supporting strand (C).
d. Add B and C together and subtract from A to obtain the shield current.

NOTE: The T305 Clamp must be completely closed for all readings to insure accuracy.

By measuring the current as described, the longitudinal current flowing through the conductor bundle and the supporting strand current are eliminated. The final calculation provides only the shield current.

2. Measurement (A) should be taken on both sides of the terminal and two calculations recorded, the office side and the field side (Figure 2). The core plus the strand current, -(B+C), is the same for both calculations.

NOTE: Current flowing through the metal bars clamped to the cable shield for electrical continuity can be used to measure shield current if they all are accessible to a clamp-on ammeter without including the core or supporting strand.

4.5.03 Little or no shield current will be present if there is an open in the shield path to ground. Usually less the 50 mA on the shield. Less than 50 mA shield current usually indicates a bonding problem. It may be at the location being tested or further out along the cable route.

*A_O = Office Side
*A_F = Field Side

4.5.04 BOND INTEGRITY IN AN AERIAL CLOSURE - A technique similar to the one in 4.5.08 can be used to check bond integrity for aerial facilities. Begin by tightening all screws and bolts at the aerial closure.

1. Place the bypass probe wire across the aerial cable terminal from cable shield to cable shield while monitoring the bypass current through the wire with the T304/T305 current meter and clamp-on probe.
2. If any current flows through the bypass conductor, rework all bonding connections.

4.5.05 PEDESTAL TERMINAL TESTING

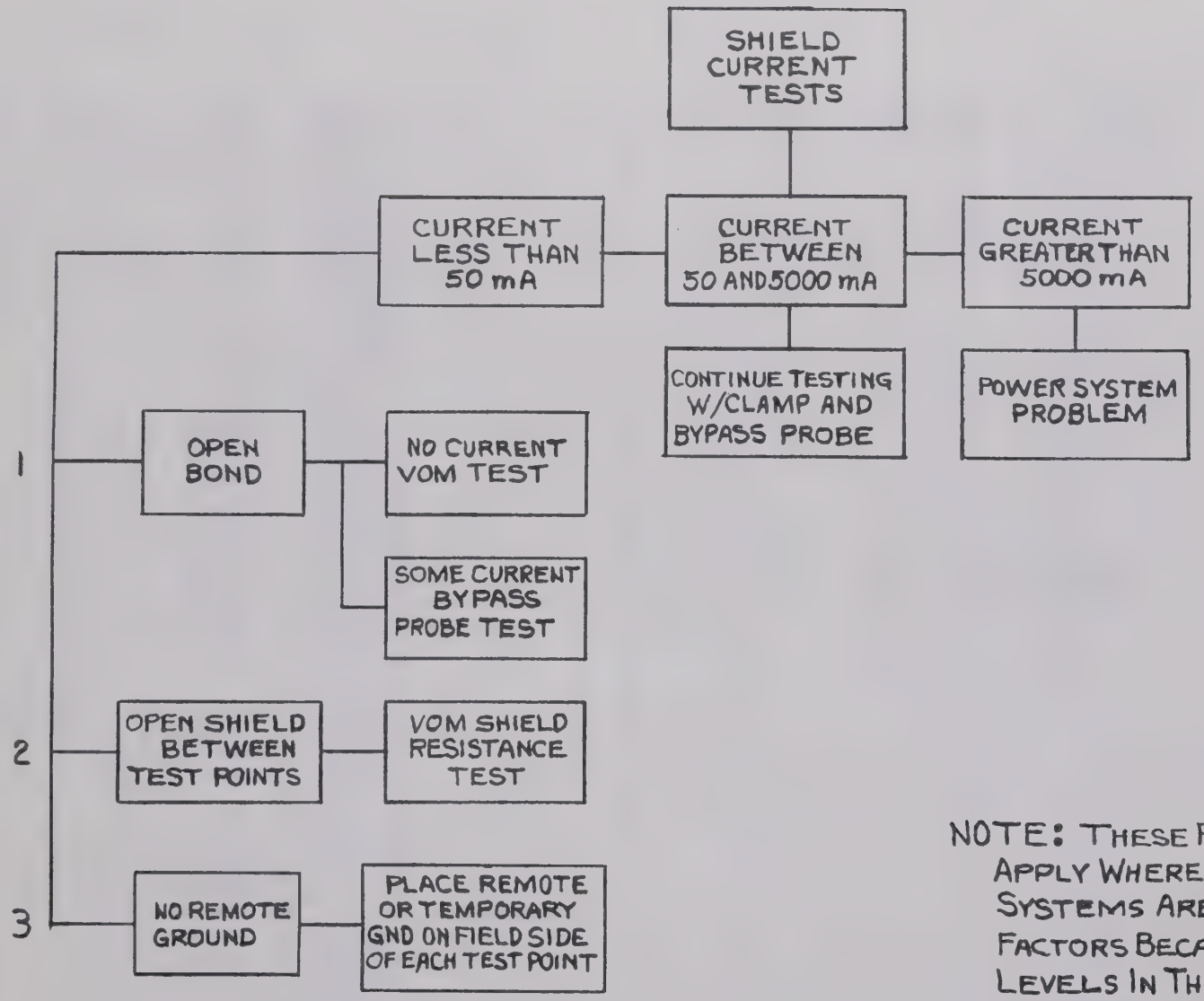
1. The current in each possible path to ground should also be read and recorded (refer to figure 1). In a pedestal the single ground wire might not be accessable. The current flowing to ground should then be read by clamping around all the ground wires leading to the common lug. The current in each wire should be recorded also and compared with the total. Other ground connections include MGN, ground rod, customer protector, shield grounds etc.
2. The most current will flow toward the ground with the least resistance (best ground). Interpretation of the data begins by asking why the current flow is larger through one path than through another. When the current has been measured in all paths at the test location, the paths with the lower readings usually have high resistance or even open bonds or poor ground connections.
3. A resistance as small as one half an ohm at a connection is enough to restrict some current flow and should be reworked. At the low voltages usually involved two ohms may block most of the current flow. Since resistance cannot be read when a voltage exists across a band, the method of 4.5.08 can be used to check bond integrity if there is still a question.

4.5.06 Many variables affect the amount of induced current in a cable shield.

a. Resistance of shield circuit
b. Ground impedance at both ends
c. Proximity of power lines
d. Length of exposure
e. Power line loading
f. Bond integrity at all connections

It should be remembered that no accurate method exists for estimating the shield current at a particular location. Poor bonds are located by comparing the amount of current flowing in the shield circuit and through various bonded connections. The procedure demands a systematic continuity of effort that includes correcting each fault before going to the next splice.

4.5.07 When the amount of shield current flowing has been determined, the Shield Current Test Flowchart, figure 4, will be of help in determining the test procedure to follow in order to locate the problem.


SHIELD CURRENT TESTS
CURRENT LESS THAN 50 mA
CURRENT BETWEEN 50 AND 5000 mA
CURRENT GREATER THAN 5000 mA
CONTINUE TESTING W/CLAMP AND BYPASS PROBE
POWER SYSTEM PROBLEM
1
OPEN BOND
NO CURRENT VOM TEST
SOME CURRENT BYPASS PROBE TEST
2
OPEN SHIELD BETWEEN TEST POINTS
VOM SHIELD RESISTANCE TEST
3
NO REMOTE GROUND
PLACE REMOTE OR TEMPORARY GND ON FIELD SIDE OF EACH TEST POINT

NOTE: THESE PROCEDURES DO NOT APPLY WHERE NONGROUNDED POWER SYSTEMS ARE THE INFLUENTIAL FACTORS BECAUSE SHIELD CURRENT LEVELS IN THESE AREAS ARE SIGNIFICANTLY LESS THAN FOR MGN SYSTEMS. ALSO REFER TO 5.1.01 NOTE.

FIGURE 4
SHIELD CURRENT TEST FLOW CHART

4.5.08 CABLE - BOND INTEGRITY IN A PEDESTAL - The conductance of wire bonds, bonding connectors and terminal ground lug(s) may be checked at all pedestal terminals using the following technique. First a single insulated wire about three feet long is needed with a very sharp test probe at each end.

CAUTION:
1. Do not penetrate the shield of the cable with the probe.
2. Do not probe test pressurized cable under any circumstances.
3. Always make probe tests inside terminals near the exposed cable stub.

1. Place the T305 clamp-on probe around the cable, as it enters the pedestal, below the bonding connection. Record the current flow with the T304 current meter.
2. Use the bypass probe wire to bridge each bonding connector, grounding harness, bonding lug, etc. where an open or high resistance bond could exist. See figure 5.
3. A current increase of more than 10%, when the probe wire bypass (bridging) connection is made, indicates a high resistance bond. Tighten all hardware or replace bonding connector.

4.5.09 OPEN SHIELD BETWEEN TERMINALS - This test is useful for determining the condition of the shield between splices. If current readings are still low (less than 50 mA) after shield continuity has been repaired at each terminal splice), an open shield may exist in between. When this type of shield problem is expected, it is necessary to check the shield using a digital ohmeter or a Wheatstone Bridge. The bonds and ground connections must first be opened at both ends of the cable section being tested. A working pair of wires within the shield in addition to access to the shield itself are needed to make this test. The measurements are taken as shown in figure 6. The shield resistance is calculated as shown in STEP 3 of figure 6.

1. Using the digital ohmeter or preferably a Wheatstone Bridge, measure the loop resistance R1 of an idle pair between two pedestals or splices. Record the resistance. The measurement is taken with the pair shorted at the far end, STEP 1.
2. Connect the shorted pair at the far end to the cable shield STEP 2.
3. The tip and ring of the pair at the measuring end are connected to one terminal of the bridge. The shield is connected to the other terminal of the bridge, STEP 2.

4.5.10 If the shield resistance per unit length is known and the measured shield resistance exceeds the estimated *shield resistance by 25%, a shield problem is likely to exist. If the shield resistance is well above 25% of the estimated resistance, an open most likely exists.

*Shield Resistance = Resistance per unit length x length.

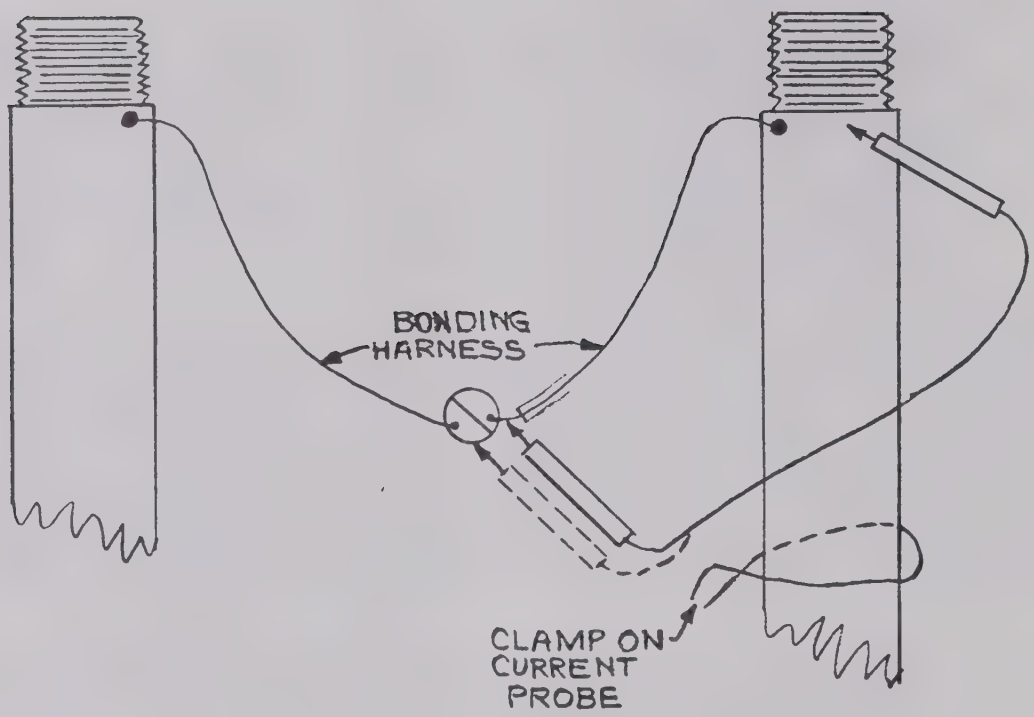
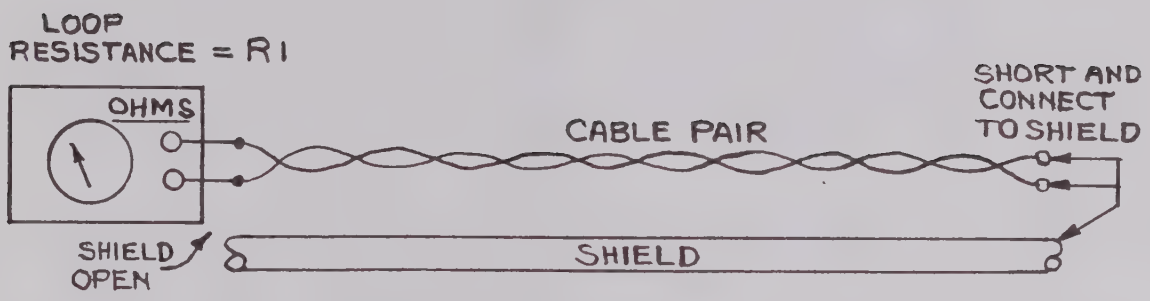
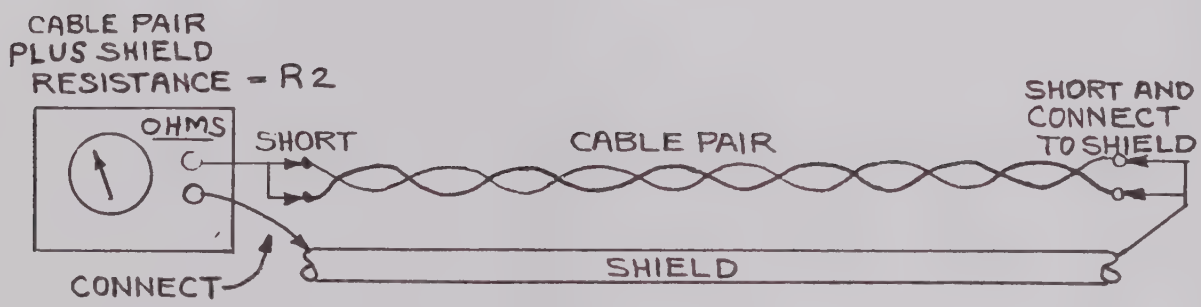


FIGURE 5
MEASURMENT OF BONDING HARNESS CONDUCTION



STEP 1. MEASURE RESISTANCE OF THE TWO WIRES OF A CABLE PAIR IN SERIES.



STEP 2. SHORT THE CABLE PAIR AND CONNECT IN SERIES WITH THE CABLE SHIELD— MEASURE RESISTANCE.

STEP 3. SHIELD RESISTANCE (RS)

$$RS = R2 - \frac{R1}{4}$$

FIGURE 6

5.0 CIRCUIT DESCRIPTION

5.1 The Model T304 is shown schematically in Figure 7-1; the printed circuit assembly in Figure 7-2. The meter circuit uses a current to voltage converter, U1A, shown in the schematic. The input current is fed directly into the summing mode; the amplifier output voltage changes to extract the same current from the summing mode through R4 and R5. A bridge circuit permits the meter to be used with ac voltages that are amplified by U1B.

5.2 Power Supply — The T304 is powered by two, nine-volt transistor batteries BT1 and BT2. The batteries are connected in series through the toggle switch S1 to the operating circuit. When battery test switch S2 is pressed with the set turned on a meter indication shows the battery condition.

6.0 MAINTENANCE

6.1 General

6.1.01 All Wilcom Products, Inc. test equipment is warranted against defects in materials and workmanship for a period of one year from the date of delivery. Complete details of the warranty can be found at the beginning of this manual.

6.1.02 Field repair of this set is NOT recommended unless the repair will be made in a well equipped repair center. The technician performing the repair should be familiar with state of art, integrated circuit and semiconductor design.

6.1.03 In the event of troubles, check the batteries for sufficient voltage to operate the set. Remove the set from the case (see Section 6.2, Battery Replacement) and check for loose or broken wiring. A technician with an understanding of the circuit functions should be able to trace signals to locate and repair any fault which may occur.

6.1.04 If local repair is not possible, it is suggested that the complete test set be returned for repair with information regarding the suspected trouble.

6.2 Battery Replacement

6.2.01 Battery replacement involves removal of the set from its case. Proceed as follows:

a. Remove the four screws from the front panel.
b. Slide the panel assembly from the case.

6.2.02 Unsnap batteries and replace with fresh.

6.2.03 Turn set on with the ON/OFF toggle switch. Check batteries with BATT TEST push button and observe meter indicator in relation to BATT OK section of meter.

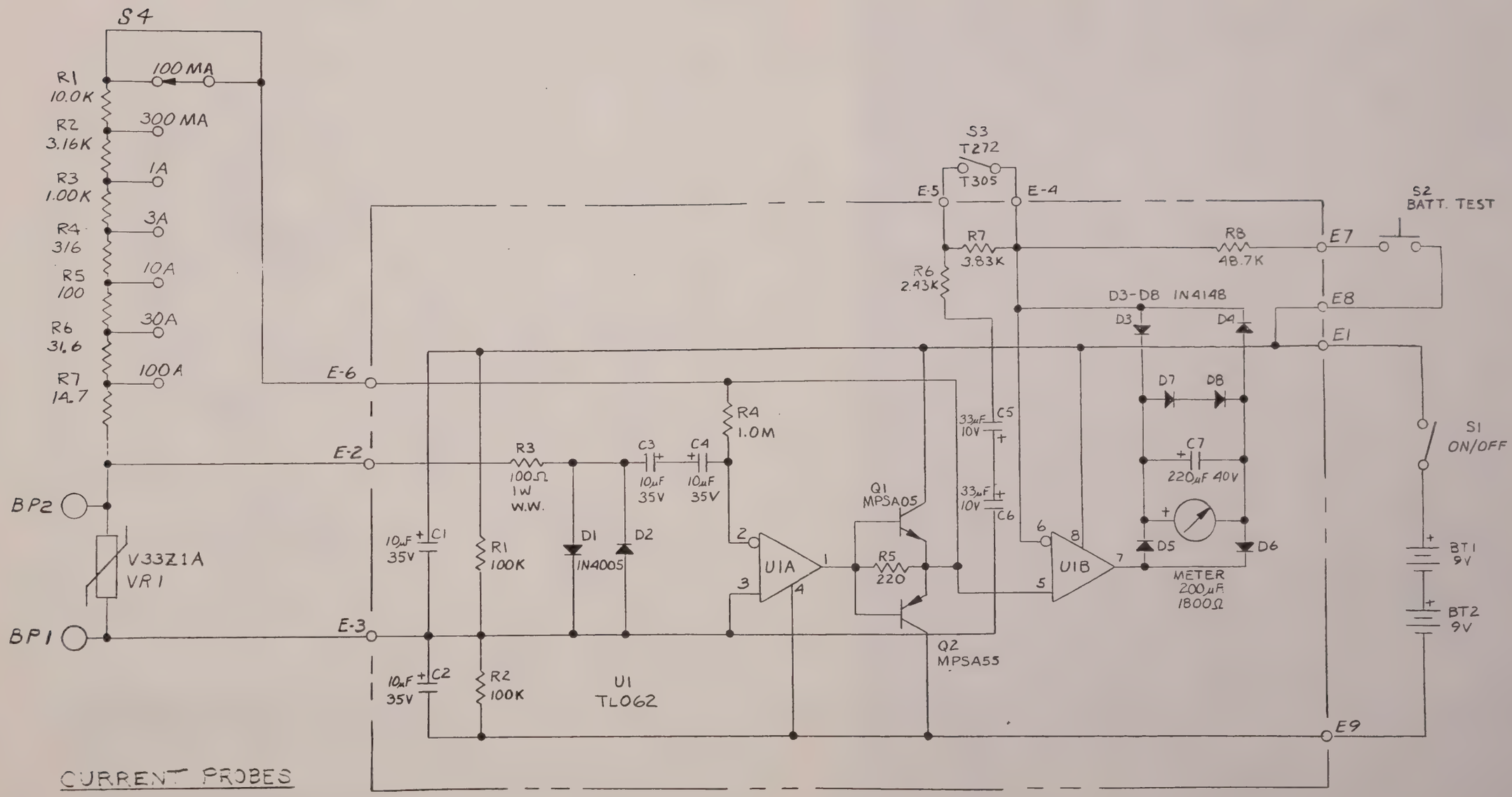
6.2.04 Return the test set to its case.

7.0 SCHEMATIC AND LAYOUT DRAWINGS

7.1 General

7.1.01 The following pages provide the drawings useful in locating and identifying the various components that make up the Model T304 Current Meter.

7.1.02 The necessary schematic diagrams and layout drawings are given to allow identification of various components, controls and terminals on the circuit boards. This information will be useful to those with the facilities to provide maintenance of the T304.



CURRENT PROBES

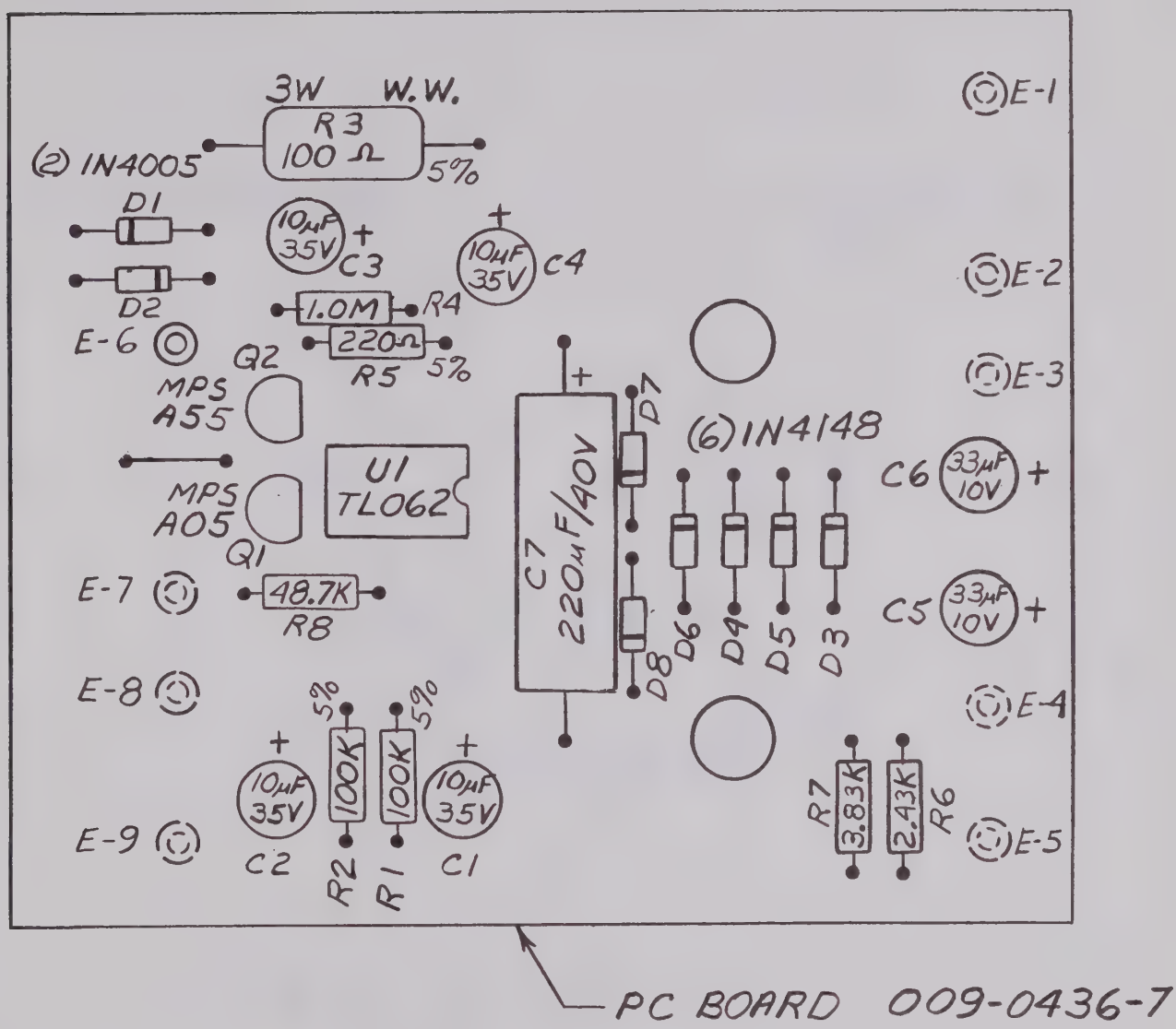
1- T305 = 2400 TURNS
T272 = 1000 TURNS

2- 2400 TURN PROBE ASSUMING 95% COUPLING:
AT ONE AMPERE:

$\frac{1A}{2400} \times 1462\Omega \times .95 = .56$ Vrms TO U1B
$\times .9 = .52$ VAV. ABS. VAL TO U1B

$\frac{.52}{2.61K\Omega} = 200\mu A$ (METER FULLSCALE)

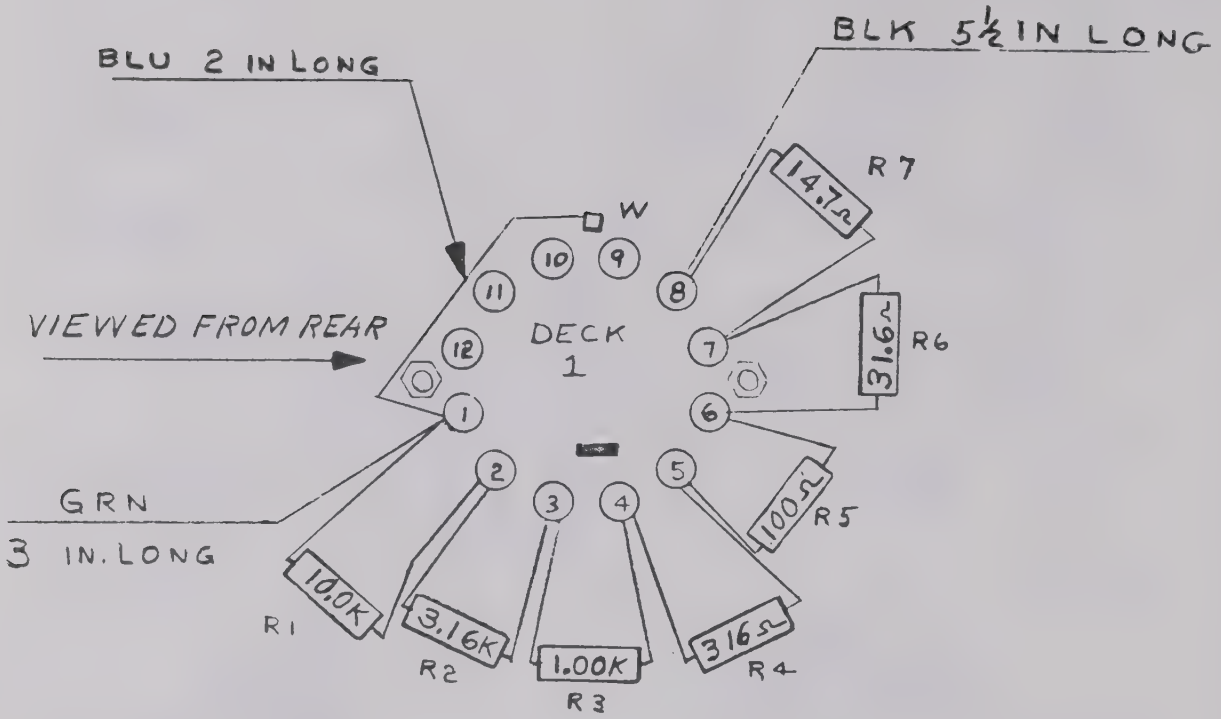
Figure 7-1
CURRENT METER SCHEMATIC



UNLESS NOTED, RESISTORS 1/4W
3 PLACE VALUES ±1% OTHERS ±5%

HIGHEST COMPONENT REFERENCE DESIGNATION		
R8	C7	D8
Q2	U1	E-9

Figure 7-2
CURRENT METER
PC ASSEMBLY



NOTE:
ALL RESISTORS ±1%

Figure 7-3
SWITCH ASSEMBLY

8.0 PARTS LIST

8.1 General

8.1.01 The parts lists provided on the following pages supply the description of the various assemblies and components that make up the Model T304 Current Meter.

8.1.02 For those components purchased by Wilcom, the manufacturer and manufacturer's part number are provided. Those components manufactured by Wilcom are identified by a Wilcom part number.

8.1.03 Any required items may be ordered direct from Wilcom Products, Inc. or the manufacturer.

PARTS LIST

T304 CURRENT METER -- 30304018

Ref. Number	Description	Qty.	Mfr.	Manufacturer's Number
	Case Assembly	1	Wilcom	20012019
	Cover Assembly	1	Wilcom	20012027
	Panel Assembly	1	Wilcom	20012001

PC ASSEMBLY, METER AMPLIFIER -- 20011979

Ref. Number	Description	Qty.	Mfr.	Manufacturer's Number
	PC Board, Meter Amplifier	1	Wilcom	00904367
R 6	Resistor, Stable Film: 1%, .25W 2.43 K	1	TRW/IRC	TO55
R 7	Resistor, Stable Film: 1%, .25W 3.83 K	1	TRW/IRC	TO55
R 8	Resistor, Stable Film: 1%, .25W 48.7 K	1	TRW/IRC	TO55
R 5	Resistor, Stable Film: 5%, .25W 220 OHM	1	TRW/IRC	RG1/4
R 1,2	Resistor, Stable Film: 5%, .25W 100 K	2	TRW/IRC	RG1/4
R 4	Resistor, Stable Film: 5%, .25W 1 MEG	1	TRW/IRC	RG1/4
R 3	Resistor, Wirewound: 5%, 3W 100 OHM	1	Ohmite	23J100
C 1-4	Capacitor, Tant Elect: DIP RAD, 10%, 35V 10uF	4	ITT Compon	TAP-F10K35
C 5,6	Capacitor, Tant Elect: DIP RAD, 10%, 10V 33uF	2	ITT Compon	TAP-F33K10
C 7	Capacitor, Alum Elect: Axial, 40V 220uF	1	Siemens	8 41283-A7227-T
D 1,2	Diode, Rectifier, 1A	2	Moto Semi	1N4005
D 3-8	Diode, Signal	6	GE Semi	1N4148
Q 1	Transistor, NPN GP	1	Moto Semi	MPSA05
Q 2	Transistor, PNP GP	1	Moto Semi	MPSA55
U 1	IC, Linear, Dual Low PWR Bi-Fet OP AMP	1	Ti Semi	TL062CP
	Bus Wire, 22AWG	A/R		

SWITCH ASSEMBLY, ATTENUATOR -- 20011995

Ref. Number	Description	Qty.	Mfr.	Manufacturer's Number
S 4	Switch Rotary	1	Oak Indust	399418K
R 1	Resistor, Stable Film: 1%, .25W 10.0 K	1	TRW/IRC	TO55
R 2	Resistor, Stable Film: 1%, .25W 3.16 K	1	TRW/IRC	TO55
R 3	Resistor, Stable Film: 1%, .25W 1.00 K	1	TRW/IRC	TO55
R 7	Resistor, Stable Film: 1%, .25W 14.7 OHM	1	TRW/IRC	TO55
R 6	Resistor, Stable Film: 1%, .25W 31.6 OHM	1	TRW/IRC	TO55

SWITCH ASSEMBLY, ATTENUATOR -- 20011995 -- Continued

Ref. Number	Description	Qty.	Mfr.	Manufacturer's Number
R 5	Resistor, Stable Film: 1%, .25W 100 OHM	1	TRW/IRC	RN550
R 4	Resistor, Stable Film: 1%, .25W 316 OHM	1	TRW/IRC	TO55
	Wire, Hookup 22AWG	A/R		

PANEL ASSEMBLY -- 20012001

Ref. Number	Description	Qty.	Mfr.	Manufacturer's Number
	Panel	1	Wilcom	04411005
	PC Assembly, Meter Amplifier	1	Wilcom	20011979
S 4	Switch Assembly, Attenuator	1	Wilcom	20011995
S 2	Switch, Push Button, Spot, Red Button	1	SWCRAFT	903
S 1	Switch, Toggle, Spot, Solder Terminals	1	ALCOSWITCH	MTA 1060
S 3	Switch, Toggle	1	AMERSWITCH	ST1-1BL2
M 1	Meter	1	Wilcom	01500628
	Binding Post, Black	2	GRAYHILL	29-1 BLK
VR 1	Varistor, Protective	1	GE SEMI	V33ZA1
	Knob, BLK: 1/2 Dia W/BAR 1/4 BUSH	1	BUCKEYE	PS-50BL-2-BLK
	Battery Holder	2	KEYSTONE	71
	Bracket, Battery	1	Wilcom	04411013
BT 1,2	Battery, Carbon-Zinc: 9 Volt	2	UNION CARB	216
	Battery Strap (For 9V transistor Bat)	2	KEYSTONE	83
	Wire, Hookup 22AWG	A/R		

9.0 DIFFERENCE DATA

9.1 General

9.1.01 This section of the manual indicates information relative to changes in circuitry, operation, and features of the Model T304 Current Meter.

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MANUAL CHANGE INFORMATION

PRODUCT T304

ASSEMBLY METER AMPLIFIER

CHANGE	DESCRIPTION

E.C.O. 1356

Serial Numbers 301 and up

An active Phantom Ground Circuit, P.C. assembly 200-1453-6 has been added to the Current Meter P.C. assembly Section 7.0, figure 7-2. The circuit is also shown on the Current meter schematic. The location of the circuit is shown on pages 9-3 and 9-4.

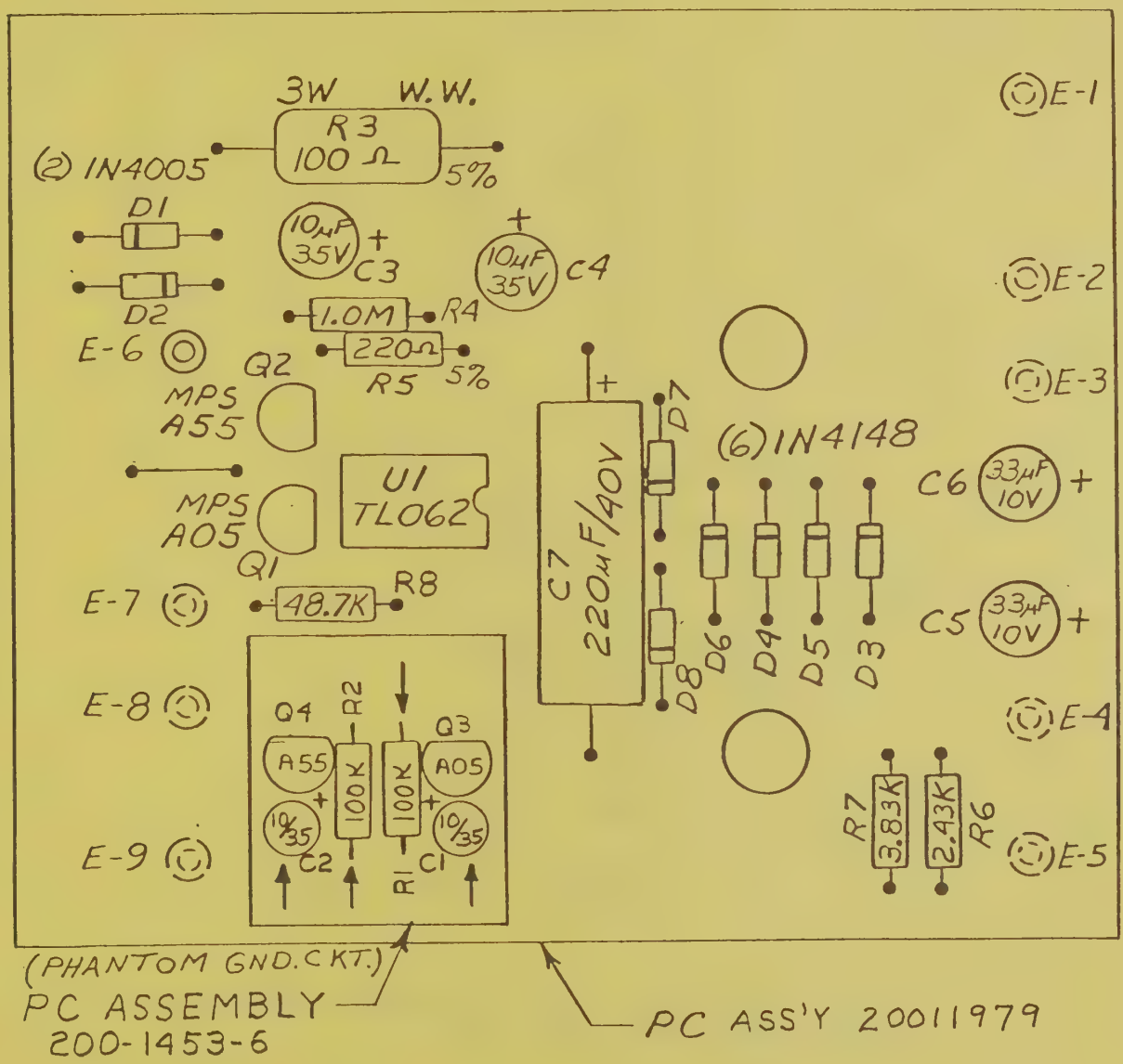
ADD:

P.C. Assembly, Phantom Ground Circuit--20014536

Ref. Number	Description	Qty.	Mfr.	Manufacturer's Number
R1,2	Resistor, Stable Film: 5%, .25W 100K	2	TRW/IRC	RG1/4
C1,2	Capacitor Tant. Elect. 10%, 35v 10μF	2	ITT COMPON	TAP-F10K35
Q3	Transistor NPN GP	1	MOTO SEMI	MPSA05
Q4	Transistor PNP GP	1	MOTO SEMI	MPSA55

DELETE: R1 and R2 and C1 and C2 from the Parts List P.C. assembly, Meter amplifier--20011979 page 8-2.

ECO 1356



NOTE:
LEADS INDICATED BY ARROWS
USED TO SOLDER SMALLER BOARD
TO LARGER BOARD

Figure 7-2
CURRENT METER
PC ASSEMBLY

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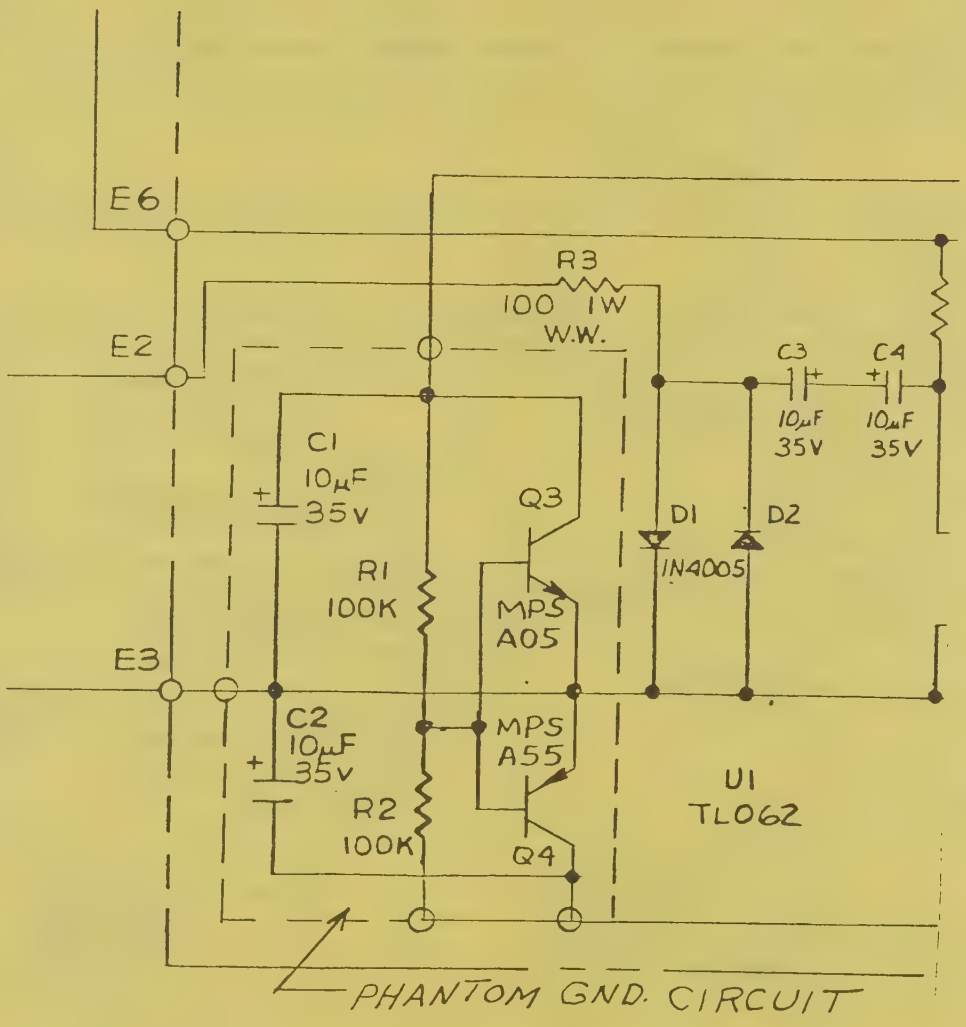
MANUAL CHANGE INFORMATION

PRODUCT T304

ASSEMBLY METER AMPLIFIER

CHANGE	DESCRIPTION

ECO 1356



The Phantom Ground Circuit Superposed on the Current Meter Schematic of Figure 7-1.

Asst. Ryan
X See Back

PLANTRONICS
Wilcom

Telecommunications Test Equipment

Final Quality Asssurance Acceptance

Test Procedure

Test Procedure No. 304/305

Written By D. Leclerc

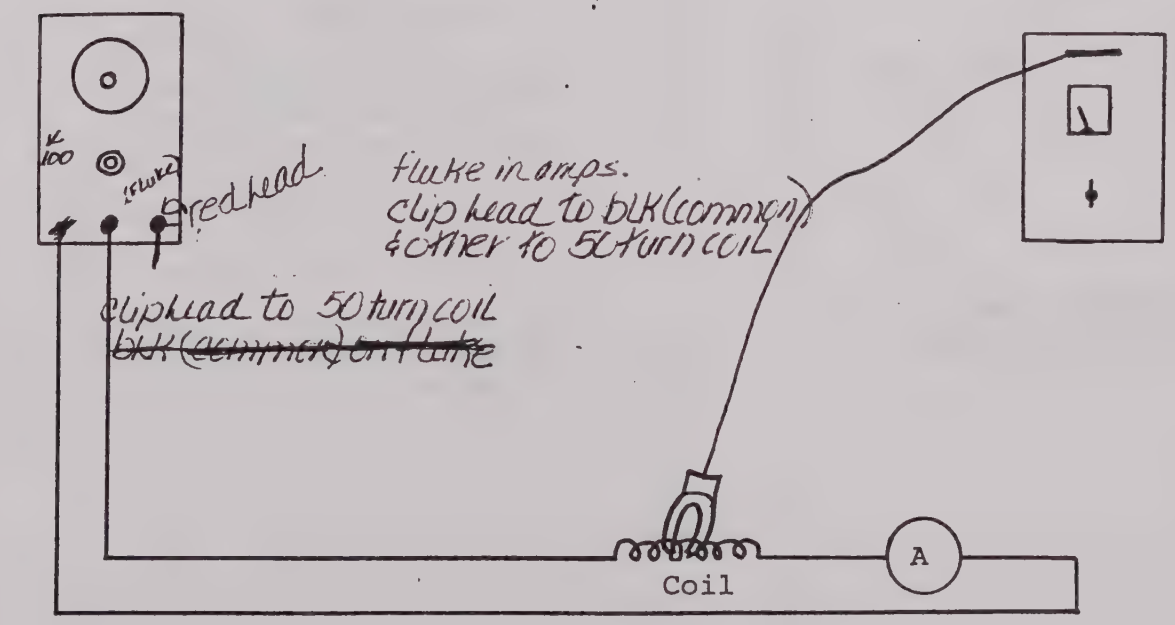
Approved By R. Barker

Revision					
Date Revised					
Approval					

PLANTRONICS Wilcom P.O. BOX 508 Laconia, NH 03246	FINAL QUALITY CONTROL TEST PROCEDURE	Procedure No. 304/305 Sheet No. 1 of 5 Sheets
	Title: T304/T305 Current Meter & Probe	Date Issued December 1, 1983 Written By D. Leclerc Approved By R. Barker

STEP	RESULTS
TEST EQUIPMENT REQUIRED A. HP 200CD Oscillator B. Ammeter C. 50 Turn Coil D. 100 Turn Coil E. Wilcom Model T272 F. Wilcom Model T305 MECHANICAL INSPECTION A. Examine case and panel for loose or missing hardware or scratches. B. Verify that serial number on unit and on Product Identification tag correspond. TEST SET-UP A. Connect oscillator to 50 turn coil and monitor current with ammeter. B. Set current probe around coil and connect to T304. SEE DIAGRAM ON PAGE 2.	

PLANTRONICS Wilcom P.O. BOX 508 Laconia, NH 03246	FINAL QUALITY CONTROL TEST PROCEDURE	Procedure No. 304/305 Sheet No. 2 of 5 Sheets
	Title: T304/T305 Current Meter & Probe	Date Issued December 1, 1983 Written By D. Leclerc Approved By R. Barker



1 amp per turn

PLANTRONICS Wilcom P.O. BOX 508 Laconia, NH 03246	FINAL QUALITY CONTROL TEST PROCEDURE	Procedure No. 304/305
		Sheet No. 3 of 5 Sheets
	Title: T304/T305 Current Meter & Probe	Date Issued December 1, 1983
		Written By D. Leclerc Approved By R. Barker

STEP	RESULTS
ELECTRICAL TESTS	
A. Clamp T272 around coil and connect it to T304.	
1. Select T272 on T304.	
2. Set oscillator to 1 kHz and adjust level for 10 mA ammeter reading.	A. 2. T304 reads 500 ± 53 mA.
B. Replace T272 with T305.	
1. Select T305 on T304.	
2. Vary current and switch through 100 mA, 300 mA, 1 A, and 3 A scales.	B. 2. T304 reads properly according to table on page 4.

PLANTRONICS Wilcom P.O. BOX 508 Laconia, NH 03246	FINAL QUALITY CONTROL TEST PROCEDURE	Procedure No. 304/305
		Sheet No. 4 of 5 Sheets
	Title: T304/T305 Current Meter & Probe	Date Issued December 1, 1983
		Written By D. Leclerc Approved By R. Barker

Ammeter	T304	Tolerance
.2 mA	10 mA	1 mA
2 mA	100 mA	10 mA
4 mA	200 mA (300ma on T304)	20 mA
6 mA	300 mA (300 ma)	30 mA
8 mA	400 mA (1am) .4	40 mA
10 mA	500 mA (1a) .5	50 mA
16 mA	800 mA (1a) .8	80 mA
20 mA	1 A (3a)	100 mA
30 mA	1.5 A (3a)	150 mA

PLANTRONICS Wilcom P.O. BOX 508 Laconia, NH 03246	FINAL QUALITY CONTROL TEST PROCEDURE	Procedure No. 304/305 Sheet No. 5 of 5 Sheets
	Title: T304/T305 Current Meter & Probe	Date Issued December 1, 1983 Written By D. Leclerc Approved By R. Barker

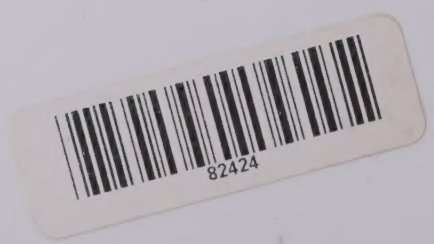
STEP	RESULTS
3. Set oscillator for 10 mA.	3. Meter reads 500 mA.
4. Vary frequency from 60 Hz to 3 kHz.	4. Reading remains the same ± 50 mA.
C. Replace 50 turn coil with 100 turn coil.	
1. Set current for 30 mA on ammeter.	
2. Select 10 A, 30 A, and 100 A scales.	C. 2. T304 reads 3 mA.
TEST COMPLETE	

~~Use Dyn. Coup.~~

Loop Cable From Calibrator one loop.

Alot of Open meters

Meter deFlection = Ship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